SCIENTIFIC REPORTS

ON

THE MARTIN PROCESS

FOR

Fireproofing & Other Preserving Purposes.

The Martin Process and Chemical Company,

41 COURTLANDT STREET, - - NEW YORK CITY.

(1887.)

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THE MARTIN PROCESS & CHEMICAL CO.

41 CORTLANDT STREET,

New York City.

RAILWAY & GENERAL PRINTING CO.,
8 SPRUCE STREET, N. Y.

Society for the Advancement of National Industry.

REPORT BY PROFESSOR TROOST.

On a Comparative Investigation of All Processes Directed to Rendering Tissues, Wood, Etc., Uninflammable.

GENTLEMEN :—

Numerous experiments have been conducted to discover a process for rendering tissues, wood, &c., uninflammable and thus prevent fires.

This question was considered of such great importance that it occupied the attention of the Council of the Society for the Advancement of National Industry for many years, especially as regards the security of the public in theatres and buildings at large. As long ago as 1829 the Society offered a prize of 1,500 francs to the Inventor of a Process for rendering tissues, wood, &c., uninflammable.

The prize was open to competition for six years but was finally withdrawn.

In 1838 a police ordinance directed the theatres to use exclusively, tissues, linens, wood, &c., which had been rendered uninflammable.

This ordinance was put into effect for a while, but when tests were conducted to ascertain the uninflammability of the linens thus treated, it was found that they readily took fire from the flame of a wax candle just as ordinary linens would have acted even at the time they were first put into use. The enforcement of the ordinance was then abandoned.

The failure, when officially stated, threw distrust upon all similar processes.

For this reason the managers of the Theatres found a reasonable excuse to refuse to experiment with processes which had not been tested as to durability and efficiency, and proved of value.

And as experiments conducted in Theatres would be conclusive, no solution to the problem could be arrived at.

However, as numerous fires have lately occurred in the theatres in various countries, public attention was again directed to the advantages that would be derived by a process which would render tissues, wood, &c., uninflammable.

As numerous preparations have recently been patented, the moment seemed to arrive when a new examination of the question should be instigated, and the "Committee of the Chemical Arts" of the Society offered a prize to the inventor of a process that would render wood, tissues, &c., uninflammable, provided such process conformed with the following conditions :

1st. The substance or compound must be cheap and easy to apply.

2d. It must not affect the tissues nor the colors of the same, or such colors as might afterwards be applied.

3d. It must be neither poisonous nor corrosive.

4th. It must not be affected by an excess of moisture in the air or by excessively dry air.

5th. And finally, the tissues or wood impreguated, after being exposed during one month to a temperature of 40° to 50° C (104°–122° F.) must remain uninflammable.

Common tissues were selected for the experiments, such as linens for stage scenes and decorations and painted wood. It being considered that the process that would succeed with common thick linens would also succeed with light material such as the costumes of ballet girls.

Only one competitor fulfilled the conditions, and that was Prof. Abel Jean Martin, No. 12 Rue de Fonutarabie, Paris, who presented various preparations.

The examination of the processes of the inventor, and of the various samples of material rendered uninflammable by him, were submitted to a special committee consisting of three members—Messrs. Ernest Dumas, Paliard and Troost—chosen from the three Departments, namely: from the Fine Arts, Economical Arts and Chemical Arts.

To completely settle this question and control the action of heat upon tissues, to render them uninflammable, and consequently unable to be set on fire or be kept burning, it is necessary to satisfy the conditions pointed out by Gay Lussac in 1821, which are as follows :

1st. During the whole time of the action of the heat the tissues must have each filament protected from contact with the air.

2d. The combustible gases which the heat evolves must be mixed with a sufficient proportion of other gases which are incombustible, so as to render them uninflammable.

To comply with the first condition, it becomes necessary to coat the tissues with a very feasible compound which, at the moment heat is applied, will cover the surface of the textile filaments by adhering to them and preventing the contact of the air.

Owing to this first condition and the necessity of satisfying the same, the earthy or metallic salts (sulphate of magnesia, sulphate of zinc, sulphate of iron, etc., often proposed) are eliminated as by the action of heat or too long drying leave a pulverulent residue which simply adheres but does not prevent contact of the air, and consequently in a short time permitting combustion to proceed.

Compounds which are difficult to fuse (chloride of potassium or of sodium, sulphate of potash or of soda) fail to form a coating which is sufficiently protective. Among the fusible substances it is also necessary to reject efflorescent substances which would by degrees fall into dust—and the very hygroscopic substances (calcium chloride, silicate of potash, proposed by M. Fuchs in 1825, for the Theatre of Munich) these substances would not dry in the open air, but would attract moisture, become damp and get covered with the dust floating in the atmosphere in the places where they would be used.

The bases composing the mixture proposed by M. Martin are extremely fusible ; besides they are not altered by an excess of dampness or moisture of the air nor by very dry air—they therefore conform with the first condition required.

The second condition required is satisfied by impregnating the tissues with volatile substances which are not combustible and which will require considerable heat to vaporize, but when vaporized with the gases produced by the charing of the tissues their combustibility is thereby lessened.

The salts which M. Martin uses to form his mixture satisfies these conditions. They are volatile or decomposable into volatile products, which are not combustible themselves, and when decomposed by heat yield a mixture containing nitrogen and steam which are not combustible and also liberate at the same time carbonic, hydrochloric and sulphurous acid gases, which are capable of extinguishing a fire even during intense combustion.

The mixtures employed by M. Martin consequently fiulfill the two conditions required for rendering tissues uninflammable.

There is still another very important point to establish. It was necessary to ascertain that the material when once rendered uninflammable would retain this property even after being exposed several months to a moderately high temperature in dry air and alternately in dry and moist air.

It was necessary to establish this, for the principal objection which the managers of Theatres make to every new trial consists in referring to the experiments made in 1838, when it was conceded that linens supposed to be made uninflammable at the time lost this quality after a few months, which effect results from using efflorescent salts which by degrees fall into dust or powder.

To establish, therefore, in an incontestible manner that the tissues prepared under the Martin process retain the property of uninflammability under the conditions they are to be employed in theatres, there was exposed in a stove for several months the following materials presented by M. Martin.

1st. White tarletans and tarletans of pale red and pale blue color.

2d. Muslin used for aprons.

3*d.* Thick muslin.

4*th.* Thick linen for stage scenery and decorations.

5*th.* White and printed papers of different varieties.

6*th.* A doll cradle, with its bedding, mattress, etc. Thereby illustrating the general application of the process employed.

The above were put into a stove on the 1st of April, and the experiment was terminated on the 13th of November, seven months and a half having elapsed. The temperature duting this time was maintained between 35° and 37° C (95° —98° 6 F.) which is the highest temperature found above the stage in theatres.

The stove was also crossed by a draft of air.

The result of the experiment was as follows :

1*st.* The thick muslin and the thick linens for stage scenes and decorations remained uninflammable. They were in the same condition as similar material prepared at the same time, but preserved at the ordinary temperature.

2*d.* The white, pink and blue tarleton were also uninflammable. The pink and blue colors not being altered.

3*d.* The bed-cover, the straw mattress and the sea-weed mattress of the cradle had also remained uninflammable as well as the curtains.

4*th.* the wood of the cradle became slightly charred without taking fire.

Whilst these trials were made in the Laboratory, others were conducted in various theatres.

The stage canvas of the Palais Royal was made uninflammable and placed on the top wing of the stage on the 19th of July. On the 31st of October (that is to say, three months and a half afterwards) the members of the committee reported that the canvas was still absolutely uninflammable.

On the whole, the mixtures proposed by M. Martin for rendering tissues, wood, &c., uninflammable neither alter the tissues nor the colors of the same.

The materials, therefore, rendered uninflammable by means of these mixtures possess the property of uninflammability even after having been exposed for several months either in a stove having a temperature of 36° C or on top of the wing of a stage in a theatre.

The preparations of M. Martin have been successfully employed by M. Robecchi, to render the various stage canvases uninflammable in the Theatre des Varieties and in the Theatre des Nouveauntes.

It is also by means of M. Martin's process that the masts of the vessels in the Theatre du Chatelet in the Venus Noire, were rendered uninflammable, as every evening oakum twisted around the masts was burned in imitation of the burning of vessels.

The large stores of the Louvre have ordered from Mr. Martin thick linens which have been rendered uninflammable for covering their goods at night.

The applications of this process became more and more extensive.

The Council of the Society of Advancement decided to encourage the persevering efforts of M. Martin respecting the industrial application of his Process, especially in the preparation of stage scene decorations, as also his preparation for rendering wood uninflammable so that it will neither support combustion nor become ignited.

In consequence of which they congratulated M. Martin on his success and voted to him an award of 1000 francs.

The President forwarded to M. Martin the award with a commemorative medal and personally congratulated him on the results he had obtained.

(True Copy of the Report.) Signed, A. J. MARTIN.

PARIS, September 25, 1885.

REPORT

— OF —

EXPERIMENTS CONDUCTED IN TURIN,

By PROF. ASCANIO SOBRERO and PROF. PROPERO CARLEVARIS.

ASCANIO SOBRERO.—Prot. of Chemistry in the Royal School of Engineering, Secretary and member of the Royal Academy of Sciences—Commander of the Order of St. Mauritius and St. Lazarus—Knight of the Civil Order of Savoy—Officer of the Order of the Crown of Italy.

PROSPERO CARLEVARIS.—Prof. of Chemistry in the Royal Industrial Institute and Professor in the Superior Naval Academy. Commander of the Order of St. Mauritius and St. Lazarus.

The undersigned members of the Committee appointed by the Mayor of the City of Turin to examine a new system of lighting the Theatre Royal and examining a system for rendering the stage scenes, canvases, etc., incombustible, were directed, at the meeting held May 23, 1883, to form a sub-committee to examine the process submitted by the chemist, A. J. Martin, which process Messrs. Berthod and Barzoni have suggested the adoption of to the Mayor of this city.

This process, as they represent it, consists of an "ignifuge" liquid which is capable of rendering tissues, wood, straw, etc.—when properly treated—uninflammable.

The liquid is cheap and easy to apply and is neither poisonous nor corrosive, and does not alter the tissues or their color or any color that may be applied to them; it resists the action of moist or dry air and does not sensibly increase the weight or stiffness of the material which even when exposed to a temperature of 50° C. (122° F.) still remains uninflammable as in the case of wood so prepared.

The representatives of Mr. Martin set forth in their request how the process has been rewarded at the competitive examination started in France by the "Society for the Advancement of National Industry," as a result of an elaborate report by the eminent chemist Troost, Professor in the Faculty of Sciences, Paris.

This report was based on a series of experiments made on a small and large scale, which experiments had demonstrated that the process complied with all the conditions of the competitive test and had given entire satisfaction.

A prize of 1000 francs and a commemorative medal was granted to the inventor.

With the copy of the before-mentioned report of M. Troost, we received on the 7th of June from Messrs. Berthod and Barzoni thirteen samples or cuttings of material rendered uninflammable by means of "Ignifuge," as also six bottles of this liquid sealed and labeled Nos. 1, 2, 3, 4, 5, 6, stating the application that could be made of each and the mode of application.

The undersigned cut samples from each piece of material submitted, preserving the remainder, and sought first to ascertain if the tissues and paper of the prospectus treated with the Martin ignifuge complied with the conditions stipulated in the competitive examination which were directed to ascertain the stability of this property of uninflammability.

They observed that a thin gauze material of a bright scarlet color, when exposed to the flame of an alcohol lamp and Bunsen burner, became charred at the points of contact, but did not produce any flame;

nor were other parts affected except those in contact with the flame, the color and the softness of the uncharred portion remaining unaffected. Whilst the same material not prepared was instantly burned by the flame as soon as it was brought in proximity to the same.

The same experiment was conducted with pink gauze, white cambric printed with blue figures, material with small square figures, curtain material, bluish and yellow gauze, common muslin and muslin colored with grey, green, pink, etc.

In none of these samples could the slightest alteration be observed, either in the color or in the quality of the material, which always remained the same.

The results were no less satisfactory with thick flax-linen, which contains a larger quantity of organic matter.

Finally we would state that the paper of the prospectus remained uninflammable. The uninflammability of the samples submitted by Messrs. Berthod and Barzoni were established without doubt, but the undersigned wishing to be further convinced of the efficacy of the Martin ignifuge, determined to apply it themselves to various materials; to straw, to mais leaves, to paper, linen, wood—in short, to everything that is used for stage scenes, canvases or other purposes. After procuring 14 samples of white and colored materials, boards of soft wood, linen prepared for oil painting, and having obtained from Commander Ferri two pieces of linen used for theatre painting, one of raw linen and the other of linen prepared on one side for painting, considerable of these materials were saved for future experiments and then certain portions of each material were prepared with the number of Ignifuge directed to be employed for the purpose, and the direction of the prospectus and those on the labels of the bottles marked 1, 2, 3 and 4 were followed.

The samples were first dried at a temperature of 20° to 24° C, and then heated to 40°–50° C, and are those which we have the honor to present to the committee with the remainder of the samples not prepared.

As well as the undersigned the Committee, if they wish, can easily convince themselves by other experiments that the Martin ignifuge does possess the property of rendering all materials uninflammable and unable to support combustion, which so readily support combustion when not prepared.

In the preparation of some samples and in numerous experiments, the undersigned observed that some of the colored material treated with ignifuge lost their color to a slight degree, but they recognized that this alteration did not come from the ignifuge liquid, as the same change took place when ordinary water or distilled water was used.

One last observation must not be omitted concerning wood prepared with Ignifuge. It cannot be denied that wood so prepared will not support combustion. The combustible gases which form inside the wood produce a flame on the side of the wood, which, however, is rapidly extinguished by the gases evolved from the decomposition of the ignifuge.

The undersigned are of the opinion that wood treated by injection will be perfectly uninflammable.

(Signed)

SOBRERO & CARLEVARIS.

REPORT BY PROF. H. A. MOTT.

To Baron R. Onffroy de Verez & Co. :

Dear Sir—The following is a report of my investigation respecting the invention of Abel Jean Martin, of Paris, relating to a "*composition for fire-proofing and other preservative purposes.*"

The object of the Invention is to render any and all combustible bodies uninflammable as well as to protect substances from fermentation, putrefaction, and the ravages of insects, etc.

As various processes have been proposed and patented from time to time, having for their object the rendering of textile fabrics, cloth, wood, etc., uninflammable, it is but proper I should mention this fact, as well as state that some of the processes are now used for such purposes, especially for window curtains, shades, etc.

The limited application of the processes which are now before the public, however, arises from the fact that materials treated by them have proved ineffectual after a very short time, and further, that the action of the gases and moisture of the atmosphere on the constituents used to render the materials uninflammable decompose the same, thus liberating acids which attack the fibre of the goods, impairing their strength and durability.

Experiment has also demonstrated that materials treated by the present process in use, which employ Tungstate of Soda, Sulphate of Ammonia, Boracic Acid, &c., are not only very difficult to iron, but as a rule when ironed change in color, becoming streaked and lose to a marked extent, their power to resist the action of flame ; in other words, they can no longer be called uninflammable as the effectiveness of the salts become impaired.

For these and many other reasons the present processes have received but little favor—the attention, however, they have received, demonstrates the importance of the subject and with what public favor a lasting and durable process would be sure to receive.

The numerous fires in Theatres and other buildings, and the consequent loss of life and property induced the *Societe a' Encouragement pour l' Industrie Nationale* to offer a prize as long ago as 1829 to the Inventor of a Process which would fulfill certain prescribed conditions, having for its object the rendering of Paper, Fabrics, Wood, &c., uninflammable. This prize remained open for competition during six years, but was finally withdrawn, as no process submitted was found to conform with the conditions required.

In 1879 another prize was offered by the Committee of Chemical Arts of the Society, and the conditions prescribed by this Committee were as follows :

First : The substance or compound used must be inexpensive and easy to apply.

Second : The preparation must not alter or injuriously effect the tissues treated or impair their color.

Third : The preparation must neither be poisonous nor corrosive.

Fourth : The preparation must not be altered, either by an excess of dampness or dryness of the air.

Fifth : The tissues or woods treated must remain absolutely uninflammable, after being exposed to a temperature of 50° C. (130° F.) for several months.

M. M. Dumas, Paliard and Troost were selected to examine the various processes submitted. As a result of a most careful examination by these distinguished Savants, the Society awarded to Mr. Martin the prize, as being the only inventor who submitted processes and preparations which fulfilled all of the stipulated conditions.

It would hardly seem necessary to submit the process and preparation of Mr. Martin to another scientific investigation after the favorable report rendered by such distinguished scientists as those who composed the above-mentioned Committee ; however, at your request, I have undertaken a series of experiments to verify the claims of the Invention, and to point out any defects in the process and preparation if such should be found to exist.

As set forth in the Patent Specifications I prepared a solution having the following constituents :

Glycerine, 28° B.	2 parts by weight.	9.71 per cent.
Carbonate of Ammonia	1 " "	4.85 " "
Chloride of Ammonium	8 " "	38.84 " "
Cream of Tartar	0.8 " "	3.84 " "
Oxalate of Potash	0.8 " "	3.84 " "
Boracic Acid	8.0 " "	38.84 " "
Total Salts	20.6 parts by weight.	100.00 per cent.

These constituents were dissolved in water, filtered and brought to a specific Gravity of 8° B.

A portion of this solution was evaporated to dryness to obtain the compound salt, which Mr. Martin has termed GLYCERO.

To test the efficacy of the solution, I immersed in the same, various articles, such as paper, laces, cloths, muslins, curtains, silks, carpets, wood, etc.; after being saturated, the excess of solution was removed and the articles were then placed in suitable positions to dry. In all cases each and every article was found to be perfectly uninflammable, the most intense heat, succeeding in only charring the articles at the particular place where it was applied, but failing in any case to induce combustion. Neither the flame of a Bunsen Burner, nor the flame of a blow-pipe, succeeded in igniting any of the articles treated.

Experiments were conducted to determine whether or not the color of the materials treated were altered or changed by the salts in the solution. Some fifteen colored muslins were obtained, which were first tested in *pure water* to ascertain if their color could be in part removed by washing; this was found to be the case—on treating these various samples of muslin with the "Glycero Solution" and drying the same—the colors were found to be preserved and not altered to any greater extent than pure water was found to alter them, which alteration was simply a removal of excess of coloring matter.

On treating various materials, the colors of which were fixed and which could not be removed by washing, the "Glycero Solution" produced no effect upon the colors, they remaining in every way as bright as before treatment, thus demonstrating that the process of Mr. Martin does not destroy or injure the color of the materials treated. Experiments were next conducted with wood, which, on being saturated with the "Glycero Solution" and dried, was found to be perfectly uninflammable. On a large scale the solution heated to 104° F., could be forced by pressure throughout the wood and made to permeate every portion. The most intense heat and flame of a Bunsen Burner failed to ignite the wood, only succeeding in charring the same at the point of application.

The durability of wood thus treated as regards being uninflammable, I have demonstrated by testing samples of wood which have been prepared for over two years, and which resist the action of flame as perfectly to-day as the day they were first prepared or treated.

The elaborate investigations conducted by Dumas, Paliard and Troost to determine whether time and the conditions of the atmosphere, such as rise in temperature, moisture, dryness or gases, would impair the effectiveness of the treated materials, settles the question as to the durability of the process, as their experiments [illegible]sted in placing the articles treated in a stove, the temperature in which was maintained for over seven months at [illegible] and [illegible]F., and through which a current of air, alternately dry and damp, was made to pass. The articles, on being removed at the expiration of this time, were found to be as uninflammable as they were when first put into the stove, and the colors of the articles remained unaltered.

I have up to this point described experiments made with solutions as set forth in the Patent Specification. I will now give the formulæ for solutions which experience has shown to be better suited for particular classes of treatment, stating, however, that all such solutions are substantially covered or protected by the patent.

CONSTITUENTS.	Silks, Laces, Curtains, &c.	Paper, Books, &c.	Wood, Straw Cords, &c.	Water Color Paintings.	Oil Paintings.	Fire Extinguisher.
Sulphate of Ammonia	54.79	54.99	25.80	.....	.....	50.00
Boracic Acid	13.69	20.56	19.35	3.23	.....	.....
Borax (refined)	20.56	13.69	19.35	3.23	Calcined 22.42	31.25
Sturgeon Glue	2.74	2.74	3.25	.....	.....	.....
Glycerine	6.85	6.85	6.45	1.70	.....	6.25
Gum Traga Cauth	1.37	.....	.....	.....	.....	.....
Albumen (egg)	.....	1.37	.....	.....	.....	.....
Chloride of Ammonia	.....	.....	25.80	8.50	.....	.....
White Lead or Oxide of Zinc	.....	.....	.....	8.50	57.17	.....
Carbonate of Ammonium	.....	.....	.....	.....	.....	12.50
Dolomite	.....	.....	.....	21.26	19.06	.....
Sulphate of Zinc (Anhydrous)	.....	.....	.....	.....	1.35	.....
Carbonate of Lime	.....	.....	.....	12.76	.....	.....
Gelatine	.....	.....	.....	2.55	.....	.....
Parchment Glue	.....	.....	.....	38.27	Oil and Turpentine	.....
Water	As directed	As directed	As directed	As directed	.....	As required
Total	100.00	100.00	100.00	100.00	100.00	100.00
Number	No. I.	No. II.	No. III.	No. IV.	No. V.	No. VI.

For the treatment of light tissues, laces, curtains, tarletans, muslins, &c., Solution No. 1 is found best adapted. This solution should be 8° B. and should be heated to 35° to 40° C (95° to 104° F.) when the various articles to be treated may be laid carefully in the same and allowed to soak for about fifteen minutes, when they are ready to be taken out and gently pressed, but not twisted or squeezed, which only musses and creases the same—after being pressed they may be hung up to dry, and when nearly dry they can be ironed as usual.

I have found after treating various materials with this solution, that there is no difficulty in ironing the same, and that in no case are the goods stained or streaked by ironing and in no case does the ironing impair the effectiveness of their uninflammable nature. Materials treated by Solution 1 in the manner described will be found perfectly soft and flexible as well as permanently uninflammable. *

I will now give the result of my experiments to ascertain the quantity of solution required for the treatment of muslins, &c. Taking the formula given in the Patent Specifications for the solution to be used, experiment showed that an 8° B. solution contained one pound of "GLYCERO" dissolved in 5¼ pints of water. A solution of 4° B., was found preferable for treating this class of materials, as when muslins, curtains, laces, &c., were treated with an 8° B. solution they were too stiff. One yard of muslin, tarletan, lace or silk required 2¾ fluid ounces of solution for treatment. One hundred yards of such material required 17.18 pints of solution. It necessarily follows that 1.62 lbs. of "GLYCERO" dissolved in water to 4° B, is the quantity required for the treatment of 100 yards of muslin, or 1 lb. of "GLYCERO" is sufficieut for the treatment of 61½ yards of such material. To ascertain approximately the cost of the solution for treatment, I have obtained the price of each constituent in lots of 100 lbs. as follows:

	CHEMICALLY PURE.				COMMERCIAL SALTS.		
Glycerine	9.71	lbs.	at	.30	$2 91	at .20	$1 94
Carbonate of Ammonia	1.55	"	at	.32	1 55	at .14	68
Chloride of Ammonia	38.84	"	at	.25	9 71	at .14	5 43
Cream of Tartar	3.88	"	at	.75	2 94	at .40	1 55
Oxalate of Potash	3.88	"	at	.50	1 94	at .25	97
Boracic Acid	38.84	"	at	.50	19 42	at .25	9 71
Total	100.00	lbs.			$38 47		$20 28

From these figures, we find that the price of "GLYCERO" per pound, when made from chemically pure constituents, would be 38½ cents, and when made from commercial salts the price would be only 20½ cts. per pound independent, however, of preparation, such as weighing mixing, &c.

As the price given for each constituent would be greatly reduced when a ton or more is purchased at a time, it is fair to estimate the cost of "GLYCERO," all prepared and ready for use, in the vicinity of twenty cents per pound. As the commercial salts will answer as well as the chemically pure.

We have yet to consider the composition and effectiveness of fire-proof paints. Referring to the table, under No. V., we find a composition for Oil Painting, and under No. IV. a composition for "Water Color Painting." In making the preparation No. V. the borax and sulphate of zinc must be anhydrous and reduced to a fine powder. In place of these constituents "Glycero" may be substituted, and is in fact preferred by the Inventor. Wood painted with No. V. (mixed with oil and turpentine as usual) will not ignite even when subjected to intense heat, or directly to the flame of a Bunsen burner.

It is not necessary to treat the wood or other material by Mr. Martin's Process, before applying the paint, for when this is properly applied, combustion of such materials is prevented.

When the mixture No. IV. is used for water color painting the wood and various materials to which it is applied are rendered perfectly uninflammable as in the cases where the "Oil Paint Mixture" was utilized.

It may also be remarked that "Glycero" may be added to cement, varnish, &c., and thus render the same uninflammable. When paper, books, covers, &c., are treated with Martin's Solution No. II. and wood by Solution No. III. they are not only rendered uninflammable but are thereafter protected from the ravages of insects, as the preparation which is absorbed is destructive to lower forms of life.

FIRE EXTINGUISHER.

The composition of the fire extinguisher is given in the table and marked No. VI. The constituents being sulphate and carbonate of ammonia, borax and glycerine dissolved in water and brought to 12° B. One of the objects of the glycerine is to prevent the fluid from freezing in cold climates and the proportion of glycerine can be regulated to suit the climate.

When this Fire Extinguisher is injected on any burning material, the salts are at once decomposed and gases are liberated which put out the fire.

By experiment it was found that a wine glass full of the extinguisher was sufficient to instantly put out a fiercely burning wood grate fire.

I consider the Fire Extinguisher a valuable preparation and capable of wide application.

Before summing up this report I would state that the selection of glycerine, as a solvent (so to speak), capable of holding and uniting intimately the various constituents employed, was the discovery made by Mr. Martin, and the success and value of his method of preparation depends upon the presence of this constituent. The "Glycero" taken up by the fibres or threads of fabrics and surrounding them, as well as the "Glycero" taken up by the pores of wood and the fibres of the same, is decomposable by the application of heat into volatile products which are not combustible, and then into non-combustible gases which extinguish any attempt to combustion the body may make when a flame is presented to it.

The glycerine also in the "Glycero" prevents the decomposition of the same in articles which have been treated and exposed to ordinary conditions, as experience has shown that all treated materials remain permanently uninflammable.

In summing up this report I would state that after a careful series of experiments I am clearly of the opinion that the invention of Mr. Martin for rendering fabrics, wood, paper, &c., uninflammable is a success and can be practically utilized and made popular, as the cost of treatment is quite insignificant in comparison to the advantages to accrue from its application.

Inasmuch as there is no combustible material used either in the construction of private house, theatres, or other buildings, or in the furnishing or decorating of the same, that cannot be rendered perfectly uninflammable by Mr. Martin's Process, and at a very trifling expense, it is my opinion that it would be highly proper for the Legislature of each State in the Union to enact a law compelling, in the future, the employment of materials thus treated for the erection and fittings of buildings, and by thus doing diminish the destruction of property by fire and the loss of life, which as a rule accompanies any large conflagration.

The advantages which would accrue from the general introduction of the Process of Mr. Martin respecting the reduction of the rate of insurance, should stimulate the public to induce their representatives in the Legislature to bring this subject before that body for prompt consideration.

It is also proper for me to remark that steamers, yachts and all vessels can likewise be protected from fire by the application of Mr. Martin's Process and thus life will be protected on water as well as on land. I certainly consider this subject worthy of the most careful and thoughtful consideration.

I am, Gentlemen,

Yours most respectfully,

HENRY A. MOTT, PH., L. L. D.

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Dec. 10th, 1886.

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* It may be well to remark that some colored muslins, &c., after being washed in pure water and losing part of their color, cannot be ironed without showing streaks, stains, &c With such materials no better results can be obtained after treatment with solution I. than with pure water. In all cases, however, where the colors are fixed no such stains or streaks occur.

REPORT BY PROF. J. OGDEN DOREMUS

COLLEGE OF THE CITY OF NEW YORK, May, 1886.

GENTLEMEN :

I have studied the United States patent of M. Abel Jean Martin, of Paris, France, assigned to M. le Baron Onffroy de Vérèz, of the same place, being a "composition for fire-proofing and preservative purposes."

I have also read the report of M. M. Ernest, *Dumas*, *Paliard* and *Troost*, a special committee appointed by the SOCIETY FOR THE ENCOURAGEMENT OF NATIONAL INDUSTRIES on the processes for rendering tissues and woods uninflammable, and commending the same.

I have likewise read the favorable report of Professor Ascanio Sobrero, Secretary of the Royal Academy of Sciences of Turin, Italy, and Professor Prospero Carlevaris, Professor of Chemistry at the Royal Industrial and Professional Institute and at the Superior School of War of Turin, a commission appointed by the mayor of that city to examine the process of M. Martin.

I have furthermore prepared the various solutions and pigments referred to in the above-mentioned documents, and have applied them to various tissues, fabrics and wood, subsequently testing the effects produced upon them, especially in reference to inflammability as hereinafter described.

No. 1. This solution was prepared and applied to lace curtains, calicoes, muslins, tarlatans, mosquito nettings of different colors.

After being dried the goods retained their characteristic properties and colors, the small amount of glycerine present prevented efflorescence of the salts on the surface of the materials and any stiffness or harshness ; they were also ironed with facility with a hot smoothing iron without changing color.

All the tissues were rendered uninflammable.

Light materials used in making ladies' and children's dresses could be treated in this manner, thus preventing many sad accidents from fire and even fatal ones.

No. 2. Various papers, plain, printed and engraved, also written documents, deeds, etc., were immersed in this solution without altering their appearance.

When dried they were uninflammable.

No. 3. In this solution pieces of wood were soaked, others were placed in the liquid, and the air in the pores of the wood was removed by means of an air-pump, the pressure of the atmosphere was then restored, thus forcing the saline solution to impregnate the wood more thoroughly. The specimens were then dried. They were found to be uninflammable.

If in addition to removing the air by exhaustion in vacuo, while the wood is immersed in a hot solution of the salts, a greater pressure than that of the air should be applied by means of a force-pump, the pores of the wood of course would become impregnated with a larger quantity of the salts.

Wood thus supersaturated and dried will not only be uninflammable, but almost incombustible.

If the ends of recently felled trees are thrust into vats containing this solution, the logs being placed in a vertical position, the saline liquid entering above will force the sap to exude below until finally the saline liquid makes its appearance.

The salts are thus easily introduced in all the pores of the wood without the employment of exhaustion-pumps or force-pumps.

I made this experiment successfully forty years ago.

Wood thus impregnated is admirably adapted for the construction of cottages, flooring in all houses, etc., for rail

cars, preventing those fearful accidents of persons being burnt when the cars are overturned and the hot coals start the conflagration. Trunks and other articles made of wood so prepared would be rendered permanently uninflammable.

Coarse cloths, ropes, carpets, etc., were treated in a similar way.

When properly dried, they were likewise uninflammable.

Such cloths, when spread over articles of merchandise which are combustible, would protect them from destruction. Agents of fire insurance companies, if provided with such cloths during a fire, could save goods from the flames and from injury from water.

The application of this solution and others to the combustible parts of marine vessels would rob the ocean voyage of one of its greatest terrors.

No. 4. This preparation was laid upon tissues, such as used for theatre decorations and on wood when very warm, with a brush as in painting in distemper.

After several coatings had been applied the various articles were tested by applying Bunsen flames thereto—they were rendered uninflammable.

The frightful loss of life which has occurred repeatedly in this country and in Europe, not only of Actors and Actresses on the stage, but of hundreds in the auditorium of the theatre, could thus be rendered impossible.

No. 5. This composition was mixed with paints and with oils.

Several coatings of this were applied by means of a paint brush to wood.

It accomplished the object, viz.: rendered the wood uninflammable.

No. 6. This solution was prepared and injected on a mass of burning wood.

A small quantity of the liquid extinguished the fire speedily through the combined agency of the water, the gases liberated when the salts were heated and by depositing a saline incrustation on the charred wood, thus preventing reignition.

Some theatres, as the "Madison Square," have reservoirs or tanks of water on the top of the edifices, to which hoses are attached in case of fire.

If the salts of No. 6 were added thereto, it would greatly facilitate the extinction of the fire and very much less liquid would be required. All are familiar with the fact that water used during a fire is frequently more ruinous to property than the fire itself.

I find that besides the property these solutions confer on the various tissues or fibres of wood of being uninflammable, the small amount of glycerine used with them enables the salts to retain a sufficient amount of moisture to prevent efflorescence.

Hence the salts remain in said tissues and wood, and the quality of inflammability is permanently retained.

Patents have been granted for saturating tissues with various salts, which render said tissues uninflammable *for a time*, but after several months the value of their protective agency is lost, the saline substances drying and falling off.

I have tested specimens that were treated twenty months ago; they were still uninflammable.

Wood thus impregnated is also protected from destruction by "dry rot," also insects.

"Moths" cannot "corrupt" tissues which have been treated with these solutions, nor does a damp atmosphere produce mildew on such goods.

The French Government have for many years sought for means for antagonizing the fearful loss of life and property through fire by checking its progress not only, but by preventing its occurrence.

They have offered prizes for the best and most successful method of accomplishing this result.

M. Martin has won the prize by his ingenious processes, and that which is of greater importance, the approval of the distinguished French chemists, Messrs. Dumas, Paliard and Troost, and of the renowned Italian chemists, Professors Sobrero and Carlevaris.

1st. The Martin solutions accomplish the desired result of rendering tissues, wood and other combustible substances uninflammable.

2d. They are durable.

3d. They are easily applied.

4th. They are inexpensive.

5th. They are neither poisonous nor corrosive.

As a result of these combined advantages the French Government have adopted them. All Theatres, Opera Houses and places of public entertainment have their curtains, scenes and dresses of actresses treated with these solutions.

Large dry goods establishments in Paris, as les Grands Magasins du Louvre and others, cover their valuable goods at night with cloths rendered uninflammable.

I take great pleasure, therefore, in heartily commending the speedy introduction of the Martin methods in our country.

Much destruction of property and many lives will be saved by its employment.

In conclusion I am happy to state that I consider the inventions of the chemist, M. Abel Jean Martin, of Paris, as not only scientific, but eminently practical.

The compositions are the best known and most effectual for preventing and extinguishing fires.

They will not only prove profitable if the business is properly conducted, but a blessing to humanity.

I have the honor to remain,

Your obedient servant,

J. OGDEN DOREMUS, M. D., L.L. D.,

Professor of Chemistry and Physics in the "College of the City of New York," and
Professor of Chemistry and Trixicology in the N. Y. Bellevue Hospital Medical College.

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